

Listing of Claims

Claim 1 (currently amended): An electrolyte composition for depositing a tin alloy on a substrate, comprising tin ions, ions of ~~one or more~~ alloying metals silver and copper or silver and bismuth, the ions of the alloying metals range from 0.01 g/L to 10 g/L, one or more multivalent compounds based on the elements vanadium, niobium, tantalum, titanium, zirconium and tungsten, an acid, a thiourea derivative, and an additive selected from alkanol amines, polyethylene imines, alkoxylated aromatic alcohols, and combinations thereof.

Claims 2-4 (canceled)

Claim 5 (original): The composition of claim 1, wherein the thiourea derivative comprises 1-allyl-2-thiourea or 1,1,3,3-tetramethyl-2-thiourea.

Claim 6 (original): The composition of claim 1, wherein the additive comprises an alkanol amine.

Claim 7 (original): The composition of claim 1, wherein the additive comprises a polyethylene imine.

Claim 8 (original): The composition of claim 1, wherein the additive comprises an alkoxylated aromatic alcohol.

Claim 9 (original): The composition of claim 1, further comprising an antioxidant compound.

Claim 10 (original): A method of depositing a tin alloy on a substrate, comprising contacting the substrate with the electrolyte composition of claim 1 and passing a current through the electrolyte composition to deposit the tin alloy on the substrate.

Claim 11 (original): The method of claim 10, wherein the substrate is an electronic component selected from the group consisting of lead frames, semiconductor wafers, semiconductor packages, components, connectors, contacts, chip capacitors, chip resistors, and printed wiring boards.

Claim 12 (original): The method of claim 10, wherein the ions of one or more alloying metals are selected from the group consisting of silver ions, copper ions, bismuth ions, and combinations thereof.

Claim 13 (original): The method of claim 11, wherein the ions of one or more alloying metals comprise silver ions.

Claim 14 (original): The method of claim 10, wherein the thiourea derivative comprises 1-allyl-2-thiourea or 1,1,3,3-tetramethyl-2-thiourea.

Claim 15 (currently amended): A method of forming an interconnect bump on a semiconductor device, comprising:

- (a) providing a semiconductor die having a plurality of interconnect bump pads;
- (b) forming a seed layer over the interconnect bump pads;
- (c) depositing a tin-alloy interconnect bump layer over the interconnect bump pads by contacting the semiconductor die with the electrolyte composition ~~of claim 1~~ comprising tin ions, ions of one or more alloying metals, an acid, a thiourea derivative, and an additive selected from alkanol amines, polyethylene imines, alkoxylated aromatic alcohols and combinations thereof, and passing a current through the electrolyte composition to deposit the tin alloy interconnect bump layer on the substrate; and
- (d) reflowing the interconnect bump layer.

Claim 16 (original): The method of claim 15, wherein the ions of one or more alloying metals are selected from the group consisting of silver ions, copper ions, bismuth ions, and combinations thereof.

Claim 17 (original): The method of claim 16, wherein the ions of one or more alloying metals comprise silver ions.

Claim 18 (original): The method of claim 17, wherein the ions of one or more alloying metals further comprise copper or bismuth ions.

Claim 19 (original): The method of claim 15, wherein the thiourea derivative comprises 1-allyl-2-thiourea or 1,1,3,3-tetramethyl-2-thiourea.

Claim 20 (original): The method of claim 15, wherein the additive comprises a polyethylene imine.